Senior Design 1 Initial Project Document
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THE GARAGINATOR

Group 5

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Project Narrative

A common problem for commuters of the era of the personal car is finding a place to park. This problem is evident among students at UCF, where many students believe there are far fewer parking spots than there are people who need to park their car during peak hours. As a result many students may spend an exorbitant amount of time searching for a parking spot, or park illegally to avoid missing a quiz or a test. Often the only reason the student cannot find a spot is because they are looking in a crowded garage/lot, when there may be a less crowded one nearby. This project aims to develop a system that could be installed in parking facilities to provide drivers with enough information to park soon after arriving on campus.

UCF attempts to approach this problem with signs outside of each of the nine garages which display to drivers whether or not the garage is full. Although it is helpful, such a system does not attempt to aid the driver in finding an available spot, only in avoiding garages without them. This results in students driving around much of campus looking for an empty garage, which is not guaranteed. Furthermore UCF has many parking lots to supplement these garages, however the parking lots have no such warning, forcing students to manually check each lot if they want to park there. This process is wildly inefficient and frustrating for the student.

Another related problem is the enforcement of parking decals in parking facilities. As it stands it is a very manual process, requiring officers to individually check every parking spot on campus, and every parking decal on those cars. This is a very labor intensive task since the decals can be located in many different places on the vehicle, or inside the vehicle. As a result it is a very slow, and error prone process.

Lastly, at the end of a long day on campus, it is common for some students to not remember where they parked their car. Since there are nine garages on campus and even more parking lots, tracking down one's car can take an embarrassing amount of time.

Our projects seeks to solve all of these problems. Our system will be able to track the location of registered and tagged vehicles inside of a parking garage, and determine which spot they are parked in. This will allow drivers to view on their smartphone exactly which spots in each garage are available, from anywhere. By detecting spots which are occupied, but not by a vehicle carrying our decal, we can determine which spots are occupied by non-registered vehicles, and are therefore parked illegally. Lastly, by searching for the location of a specific vehicle, users will be able to find their car after a long day.

To accomplish these goals our system will use a smart decal to mark each registered vehicle. A sensor package installed at fixed locations in the garage will detect and identify these decals and will detect the availability of parking spots. These devices will be connected to a web application which users can use to find empty spots, as well as their car. Lot owners will also be able to find unregistered vehicles so they can be ticketed.

Garage Sensors/Communication Specifications

- The system will be able to detect the presence of a vehicle in any arbitrary parking spot in the garage.
- The system should be able to determine if a vehicle and only a vehicle entering the garage is a registered with a UCF Parking Decal.
- If the vehicle has been registered, then its location should be recorded and made available to its owner.
- Information regarding whether a parking spot is taken/untaken should be sent out to a web server for processing and update of the mobile application.
- The system should be able to maintain working capability in Florida climate .

Mobile Application/Web server Specifications

- The application should be user friendly.
- The application should be able to map out every parking spot in a garage.
- The application should be able to track each individual spot in a garage, knowing if it is currently occupied or not, based off of information sent by embedded components..
- The application should be able to communicate with the embedded components located in the garages via web server or direct communication.
- The application should contain a secure payment method for one day parking pass.
- The application should be able to tell you the closest parking garages near a building the user selected on campus.
- The application should contain the exact amount of cars currently located in a garage as well as how many total spots are located in that same garage.
- The Web Server should be able to communicate with a DBMS such as MySQL, Cassandra, SQL Server, or Oracle.
- The Web Server should be able to communicate with the mobile application.

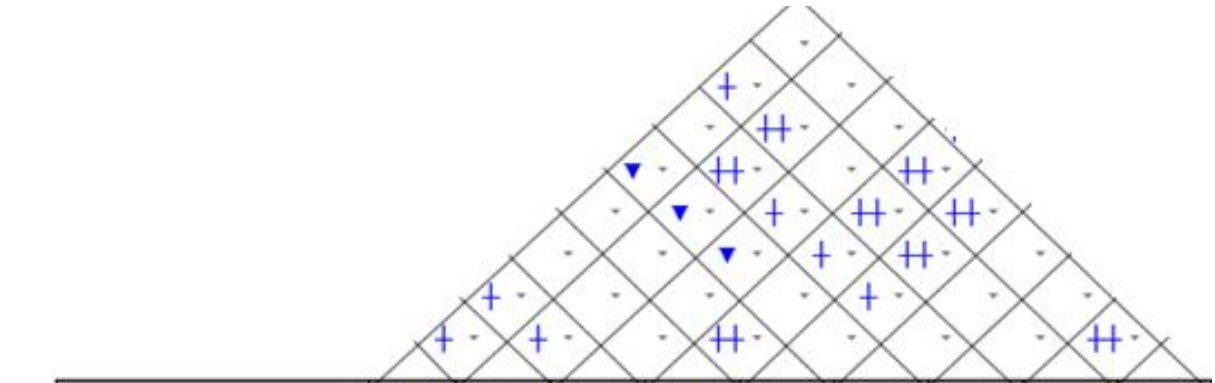
Nice to have Specifications

- Analytical data on what garages are full during certain times of the day/week/month.
- Warn users about days where less parking is typically available.
- Add sensors to detect cars that are parked over the line, and alert them using a light/noise.
- If a vehicle has not been registered, then the database should be updated with the number of unregistered vehicles in a particular garage.

Project Constraints

- Need to keep cost per spot as low as possible.
- Need to keep update time of taken/untaken spots as quick as possible.
- Time constraint of about 5 months to get the entire project working.
- We currently do not have any sponsors, so we must self fund all of the project's costs.
- Possible Sponsors could be UCF, as well as other locations which use many parking garages.

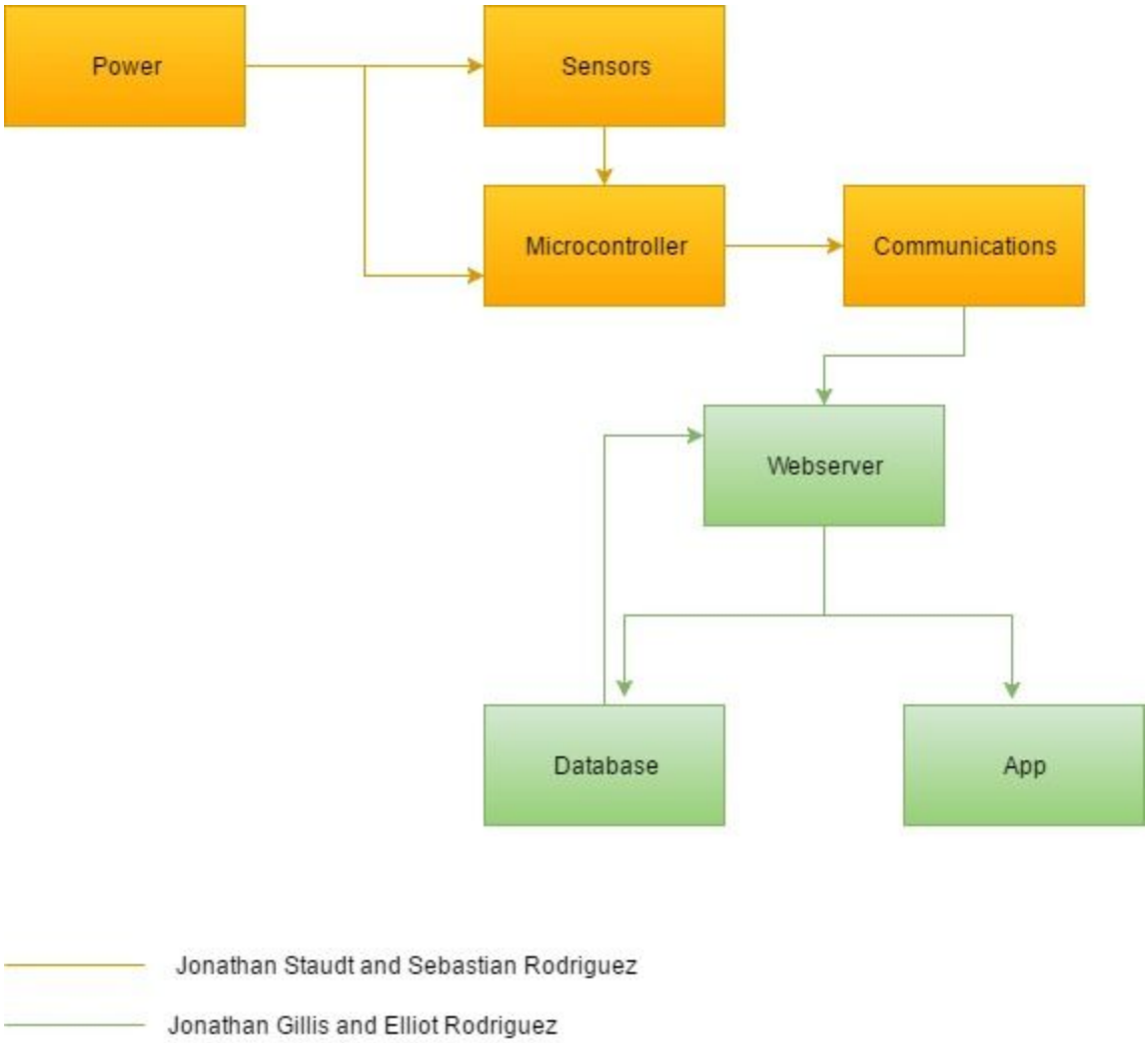
Quality Function Deployment Graph



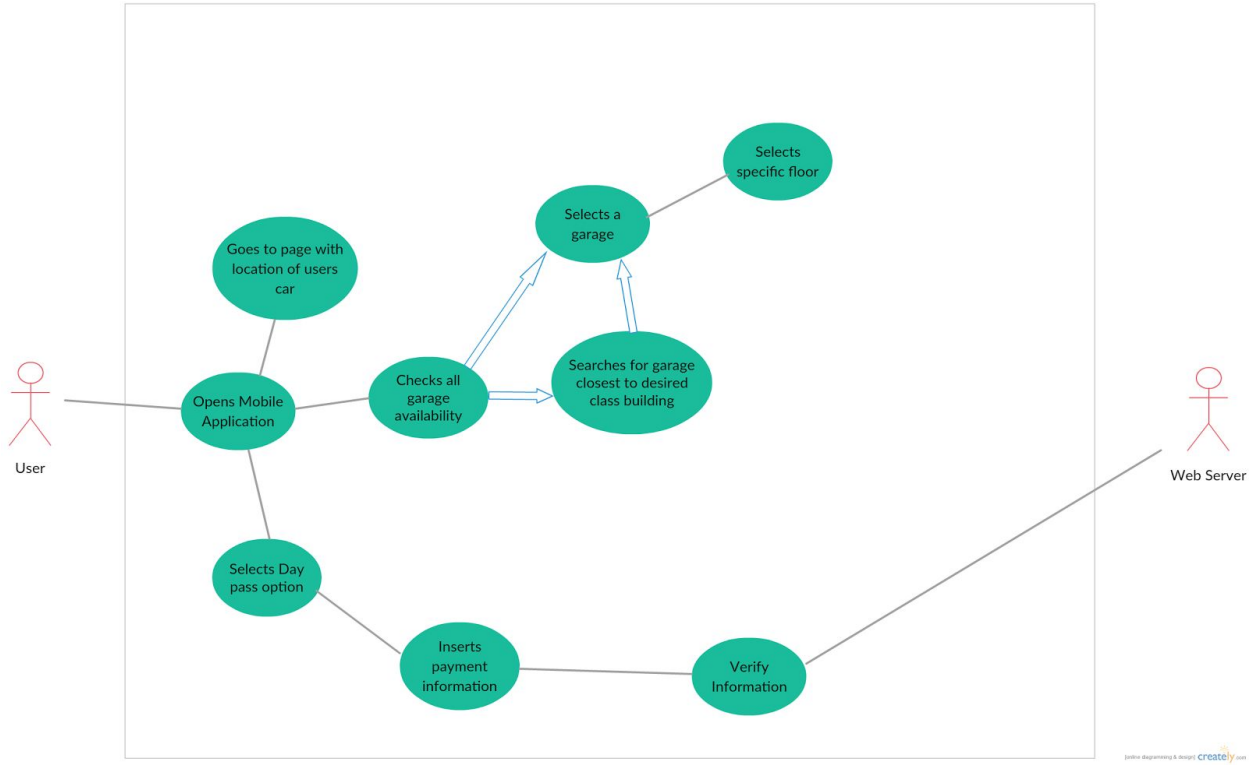
Row #	Demanded Quality (a.k.a. "Customer Requirements" or "Whats")	Quality Characteristics (a.k.a. "Functional Requirements" or "Hows")	Microcontroller	Sensors	PCB	App User Interface	Phone OS Compatability	Maintanence costs	Time to setup	Time to program	# of Steps to Program
	Column #		1	2	3	4	5	6	7	8	9
	Direction of Improvement: Minimize (▼), Maximize (▲), or Target (x)		▲	▼	▼	▲	▲	▼	▼	▲	▼
1	Reliable		⊙	⊙	⊙		⊙	O			
2	Easy to use					⊙	⊙				
3	Inexpensive		⊙	⊙	⊙			O			
4	Easy to program		O	O		⊙	O			⊙	O
5	Simplicity					⊙			⊙	⊙	O
6	Easy to install		O	O	O				⊙		
	Target or Limit Value		10 Years	10 Years	10 Years	1 Menu	iOS & Andriod	$100 per Year	2 Days	2 Months	<20
	Difficulty (0=Easy to Accomplish, 10=Extremely Difficult)		4	4	4		2	6	8	9	5

Legend		
⊙	Strong Relationship	9
O	Moderate Relationship	3
▲	Weak Relationship	1
++	Strong Positive Correlation	
+	Positive Correlation	
—	Negative Correlation	
▼	Strong Negative Correlation	
▼	Objective Is To Minimize	
▲	Objective Is To Maximize	
X	Objective Is To Hit Target	

Block Diagram



Use Case Diagram



Project Cost

ITEMS TO BE BOUGHT	AMOUNT	COST	Max Total
Microcontrollers	1 - 2	$40.00	$80.00
PCB	~ 3	$20.00	$60.00
Sensors	8	$4.00	$32.00
Copper Wiring	50 feet	$30.00	$30.00
Electronic Components (resistors/capacitors/inductors)	Bundle	$15.00	$15.00
RFID Tags	2	$22.00	$44.00
RFID Reader	1	~$200.00	$200.00
Solder	8 oz	$15.00	$15.00
Cloud Hosting Service	1 Virtual Machine	~$20.00/mo	$60.00
Electrical Piping	25 feet	$10.00	$10.00
			$546.00

Project Milestone Schedule

	Objective	Deadline	Time Frame
	Senior Design 1		
Documentation	Project Idea	5/28/2017	5/19 - 5/28
	Initial Project	6/2/2017	5/30 - 6/1
	Table of Contents	7/1/2017	6/12 - 6/29
	Draft Document	7/7/2017	6/12 - 7/2
	Final Document	8/1/2017	7/8 - 7/30
Formalization	Standards, Specifications, Constraints	6/1/2017	5/28 - 5/30
	Choose Sensors	6/7/2017	6/2 - 6/7
	Choose Microcontroller	6/7/2017	6/2 - 6/7
	Choose Form of Communication	6/7/2017	6/2 - 6/7
Prototyping	Sensor Interface	6/20/2017	6/9 - 6/19
	Power Supply	6/18/2017	6/9 - 6/17
	Communications	6/21/2017	6/9 - 6/20
Design	PCB	7/4/2017	6/17 - 7/3
	Casing	7/8/2017	7/1 - 7/7
	Connections	7/4/2017	7/1 - 7/7
	App	7/4/2017	6/17 - 7/4
	Senior Design 2		
Presentation	CDR Presentation	TBA	TBA
	Conference Paper	TBA	TBA
	Midterm Demo	TBA	TBA
	Final Presentation and Demo	TBA	TBA
	Exit Interview	TBA	TBA
Fabrication and Evaluation	Order and Assemble	TBA	TBA
	Specifications Review	TBA	TBA
	Testing	TBA	TBA